STATISTICS SOLVE CRIMES

STATISTICAL SIGNIFICANCE

Thanks to shows like CSI, NCIS, and Cold Case, many of us have become forensic science junkies. We dream of becoming the next Gil Grissom or cracking a 100 year old cold case. But, did you know, that dream may not be out of reach for statisticians? Statisticians have already had an enormous impact on forensic science, but there is still much work to be done, especially in fields such as firearm and toolmark analysis.

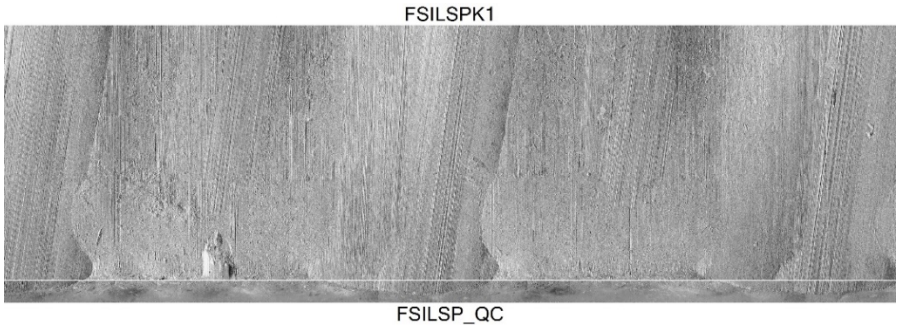
Forensic Science

HISTORY OF STATISTICS IN FORENSIC SCIENCE: Although statistical and probabilistic thinking has been used in court for centuries, it wasn't until the late 19th century that these techniques became common. A French criminologist, Alphonse Bertillon, proposed using measurements taken at various body locations (anthropometry) to identify suspects. This was the beginning of criminal identification.

A contemporary of Bertillon, Francis Galton, an English biologist, published his book *Finger Prints* in 1892. Soon after, Fingerprinting was found to be a superior method of identification, and quickly replaced anthropometry by the early 1900s.

More recently, Alec Jeffreys, a British geneticist, discovered what he called a genetic fingerprint in DNA. And, in 1985, DNA profiling was first used in a criminal case.

THE EFFECT OF DNA ON OTHER FORENSIC SCIENCE DISCIPLINES: The ability to assign a measure of certainty to DNA evidence has increased the standards of other disciplines. Specifically, there is a profound need for an objective method to improve interpretations in the firearms community.



Firearms leave unique markings on bullets and casings, potentially allowing examiners to match bullets to the firearms from which they were fired. Firearm examiners have been doing such work since the mid-1800s. Historically, an examiner would compare the markings on a bullet found at a crime scene to the markings on a test-fired bullet, and make a conclusion based on what they could see through a magnifying glass or microscope. They would then testify to this conclusion in a court of law.

Judges and juries are now demanding more. Not only do they want to know whether or not the bullets match, they want to know the numerical certainty of that conclusion. This is precisely where statisticians can play a part in solving crimes.

SURFACE METROLOGY INSTRUMENTATION: The potential impact of surface metrology instrumentation on the firearms community is significant. These systems produce high resolution images of bullet surfaces. They can also determine best match positions of two bullets, eliminating the need for the examiner to line-up the bullets, and increasing the objectivity of conclusions. Additionally, these systems compute correlation-type measurements for the bullet pairs in question. The statistician's role is to determine the ranges of these measurements for matches and non-matches, and to compute probabilities or likelihoods.

WHAT'S NEXT?: Ballistics is just the tip of the iceberg. Statisticians are needed to improve the quality of conclusions in other forensic science disciplines as well. Much work needs to be done in fingerprinting, as well as shoe prints, tire marks, bloodstain pattern analysis, tool marks, crime scene reconstruction... The list goes on and on. Forensic science is a field in which statisticians can have a "significant" impact.

"Statistical Evaluation of Surface Metrology Data in Firearm Identification"

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